The University of Jordan
Physics Department
Solutions for Chapter 6 / Giancoli
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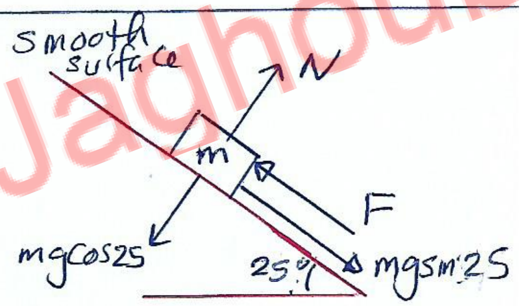
Q9] $a = 2.0\ m/s^2$,

$v_f = v_i + at \Rightarrow v_f = 0 + (2)(7) = 14\ m/s$.

$W = \Delta K = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 = \frac{1}{2}(4)(14)^2 - 0 = 392\ J$

10] $m = 380\ kg$, slides 2.9 m down the incline.



$\searrow + \quad mg\sin 25 - F = m\underbrace{a}_{=0} = 0$

(a) $\therefore F = mg\sin 25 = 1573.8$ Newtons.

(b) $W_F = (F)(2.9)\cos 180^0 = -4564\ J$

(c) $W_{mg} = (mg\sin 25)(2.9)\cos(0) = +4564\ J$.

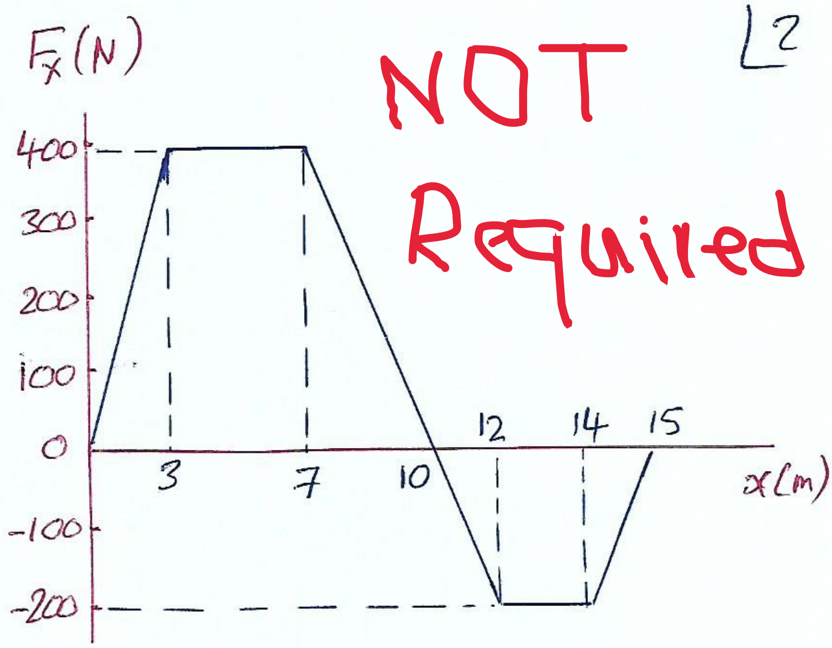
(d) $W_{total} = W_F + W_{mg} = 0$.

Since $W_{total} = 0$ the piano does NOT accelerate and moves at constant velocity down the plane.

NOT Required

~~13]~~

In an F_x versus x graph, the area under the curve represents the work done.



ⓐ $W_{0\to 10m} = \frac{1}{2}(10+4)(400) = 2800J$

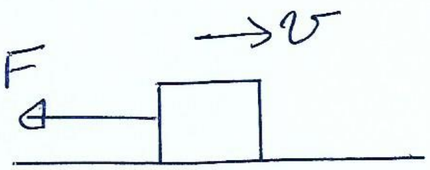
$W_{10\to 15m} = \frac{1}{2}(5+2)(-200) = -700J$.

ⓑ $W_{0\to 15m} = W_{0\to 10} + W_{10\to 15} = 2800 - 700 = 2100J$

18] $W = \Delta K = \frac{1}{2}(925)(0-(26.4)^2) = -322344J$

the work is negative since this is a stopping force that decelerates the car.

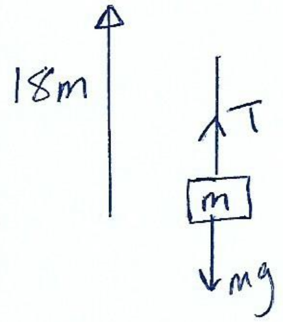
∴ Required work to stop the car is 322344J.



$\vec{F}$ and displacement are in opposite directions.

23] $m = 265\ kg$

$a = 0.16g$



(a) $\uparrow +$ $T - mg = ma$

$T = m(g+a) = 265(g + 0.16g)$

$= 265g(1.16) \simeq 3012.5\ N$

(b) $\uparrow +$ $F_{net} = T - mg = ma = 415.5\ N$ upwards.

$\therefore$ $W_{net} = (F_{net})(18)\cos(0) = 7479\ J$.

Note $W_{net} > 0 \Rightarrow$ load accelerates.

(c) $W_T = (T)(18)\cos(0) = 54225\ J$.

(d) $W_{mg} = (mg)(18)\cos(180°) = -mg(18) = -46746\ J$

$W_{net} = W_T + W_{mg} = 7479$ as in part (b) above.

(e) $v_i = 0,\ v_f = ?$

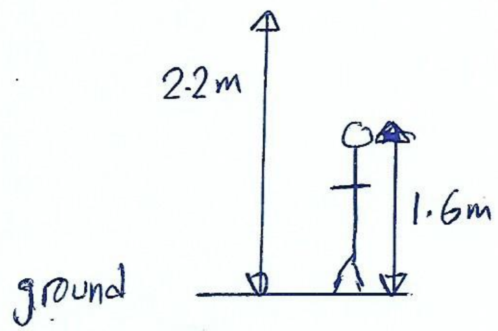
$W_{net} = \Delta K$

$7479 = \frac{1}{2}(265)(v_f^2 - 0) \Rightarrow v_f \simeq 7.5\ m/s$.

28] $m = 1.65\ kg$

(a) $U_{ground} = mg(2.2) = 35.6\ J$

(b) $U_{\substack{person\\head}} = mg(2.2 - 1.6) = 9.7\ J$



(c) $W_{mg} = -\Delta U$

$W_{person} \equiv W_{external} = -W_{mg} = \Delta U$.

36] No friction $\Rightarrow W_{friction} = 0$

N is perpendicular to displacement $\Rightarrow W_N = 0$

$\Rightarrow$ only force doing work is the weight mg which is a conservative force $\Rightarrow$

$$\Delta K + \Delta U = 0$$

$$\frac{1}{2}\cancel{m}(v_2^2 - \underbrace{v_1^2}_{0}) - \cancel{m}g(32) = 0$$

$$v_2 = \sqrt{64g} \simeq 25 \text{ m/s}.$$

To find v_3 it is best to take points 1 and 3, since $v_1 = 0 \Rightarrow$

$$\frac{1}{2}\cancel{m}(v_3^2 - 0) - \cancel{m}g(32-26) = 0 \Rightarrow v_3 = \sqrt{2g(6)} \simeq 10.8 \text{ m/s}$$

Alternatively, take points 2 and 3.

$$\frac{1}{2}\cancel{m}(v_3^2 - v_2^2) + \cancel{m}g(26) = 0$$

$$\therefore v_3^2 = v_2^2 - 2g(26) = (64g) - 52g = 12g$$

$v_3 \simeq 10.8$ m/s as before.

$$\Delta K + \Delta U = 0$$

$$\frac{1}{2}\cancel{m}(v_4^2 - v_1^2) - \cancel{m}g(32-14) = 0$$

$$v_4 = \sqrt{2g \times 18} = \sqrt{36g}$$

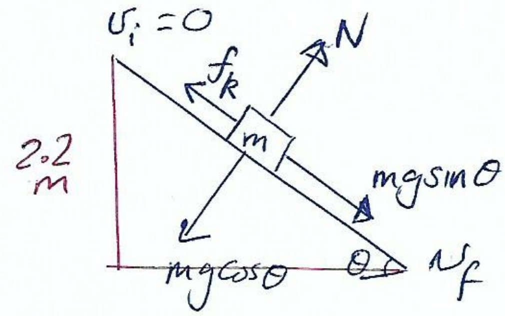
$v_4 \sim 18.9$ m/s.

One can also take point 4 with any of points 1, 2 or 3.

41] 2.2 m slide.

$m = 16\,kg$

$v_f = 1.25\ m/s$



$\Delta K + \Delta U = W_{nc}$

work done by the non-conservative force

Note $W_N = 0$

$W_{mg\cos\theta} = 0$

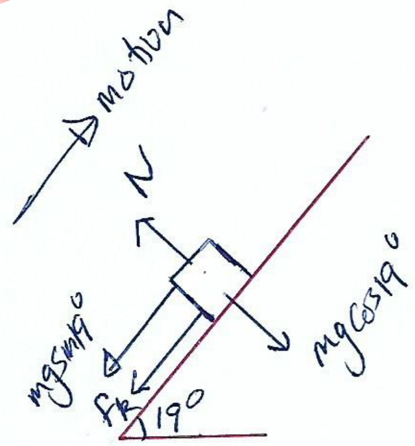
f_k is a non-conservative force.

$\therefore W_{nc} = \frac{1}{2}(1.6)((1.25)^2 - 0) - (16)g(2.2)$

$= -332.5\ J$

generated thermal energy is 332.5 J.

44] skier starts with $v_i = 11\ m/s$ and moves 15 m up the incline befor comming to rest.



f_k is a non-conservative force $\Rightarrow$

$\Delta K + \Delta U = W_{NC}$

$\frac{1}{2}m(0 - (11)^2) + mg(\underbrace{d}_{15\,m}\sin 19^\circ) = f_k(15)\cos 180^\circ$

$f_k = \mu_k N = \mu_k(mg\cos 19^\circ)$

$\Rightarrow -\frac{1}{2}\cancel{m}(11)^2 + \cancel{m}g(15\sin 19^\circ) = -\mu_k(\cancel{m}g\cos 19)(15)$

$\therefore \mu_k = \dfrac{\frac{1}{2}(11)^2 - 15g\sin 19^\circ}{15g\cos 19^\circ} \approx 0.09$

55] $P = \frac{W}{t} \Rightarrow W = Pt$

$W = (2)(746)(1\times60\times60)$

$= 5371200 \text{ J}$

$= 5.3712 \text{ MJ}$ $(M = 10^6)$

57] $h = d\sin33^\circ = 83\sin33^\circ$

$\bar{P} = \frac{\text{work done by athlete}}{\text{time}}$

$= \frac{(mg)(h)}{75} = \frac{(829)(83\sin33)}{75}$

$\simeq 484.4$ Watt.